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Graphene-metasurface for wide-incident-angle terahertz absorption

Key words: Graphene-metasurface; Terahertz absorber; Omega-shaped graphene patterns

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Motivation

1. Explore a new tunable broadband terahertz wave absorber with a very wide incident angle range.

2. A tunable terahertz absorber is compact and not sensitive to polarization.

Main idea

1. We propose a novel tunable broadband terahertz absorber that involves depositing Omega-shaped graphene patterns on a silicon dioxide substrate.

2. Planar arrays of Omega-shaped-graphene patterns are deposited on a silicon dioxide substrate, in which the unit cell consists of an Omega-shaped graphene metasurface structure and a copper mirror, separated by a silicon-dioxide layer.

Method

The proposed terahertz wave absorber has been studied and simulated using the commercial finite element method software CST Microwave Studio simulator. The terahertz wave is perpendicularly incident to the proposed terahertz wave absorber.

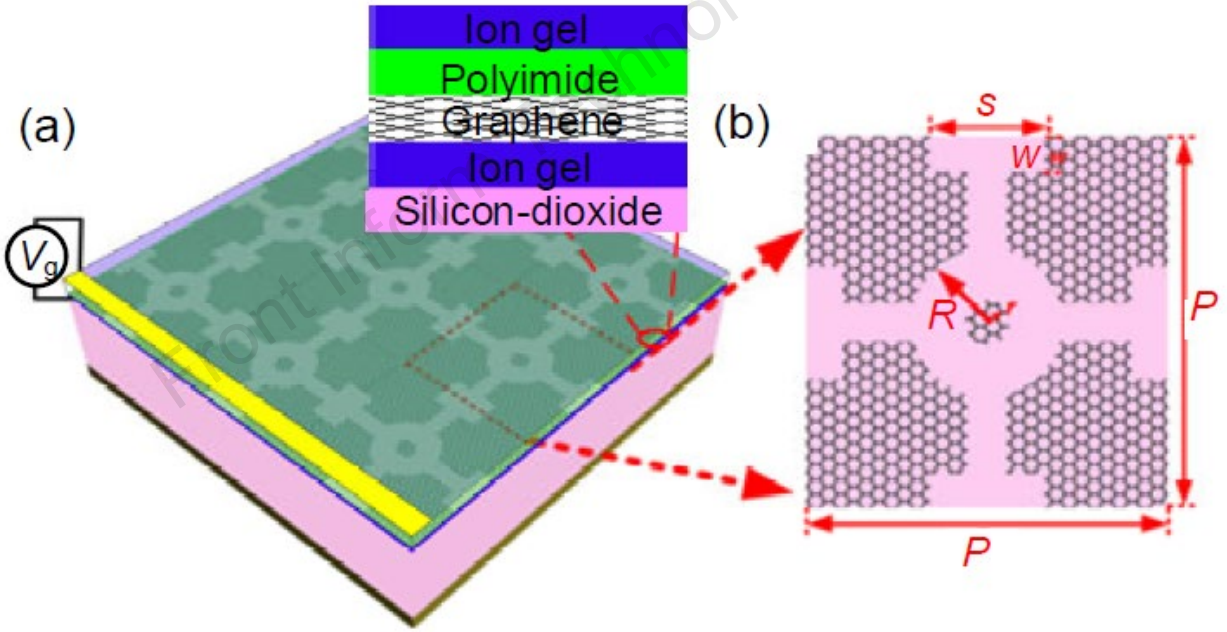
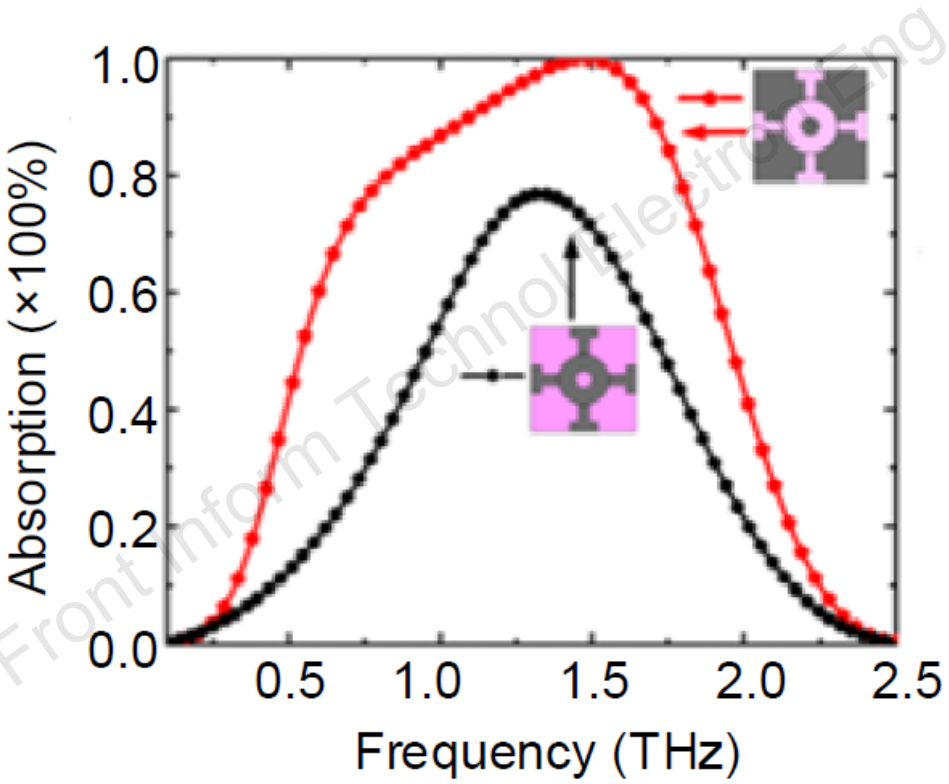


Fig. 1 Three-dimensional schematic of the terahertz absorber (a) and Omega-shaped graphene metasurface structure unit cell (b)

Major results



Terahertz wave absorption curves of Omega-shaped graphene metasurface structure and its complementary structure

Major results (Cont'd)

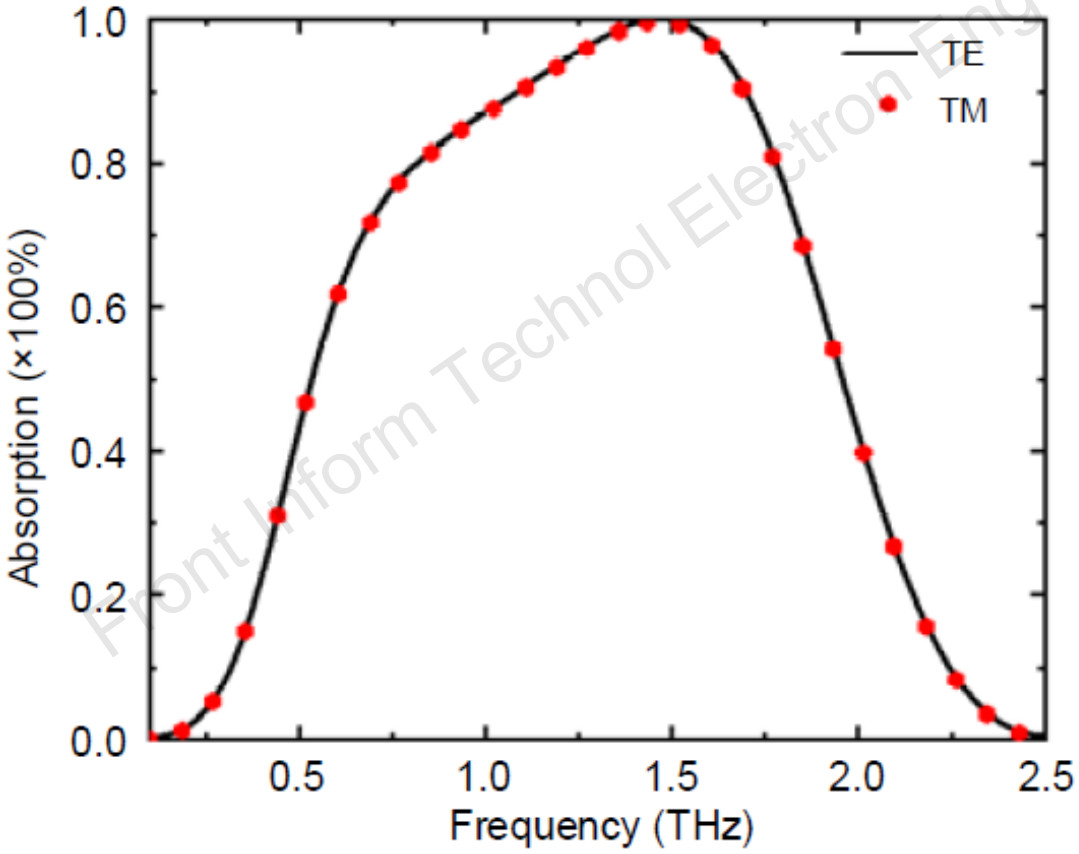


Fig. 3 Absorption of TE- and TM-polarized modes

Major results (Cont'd)

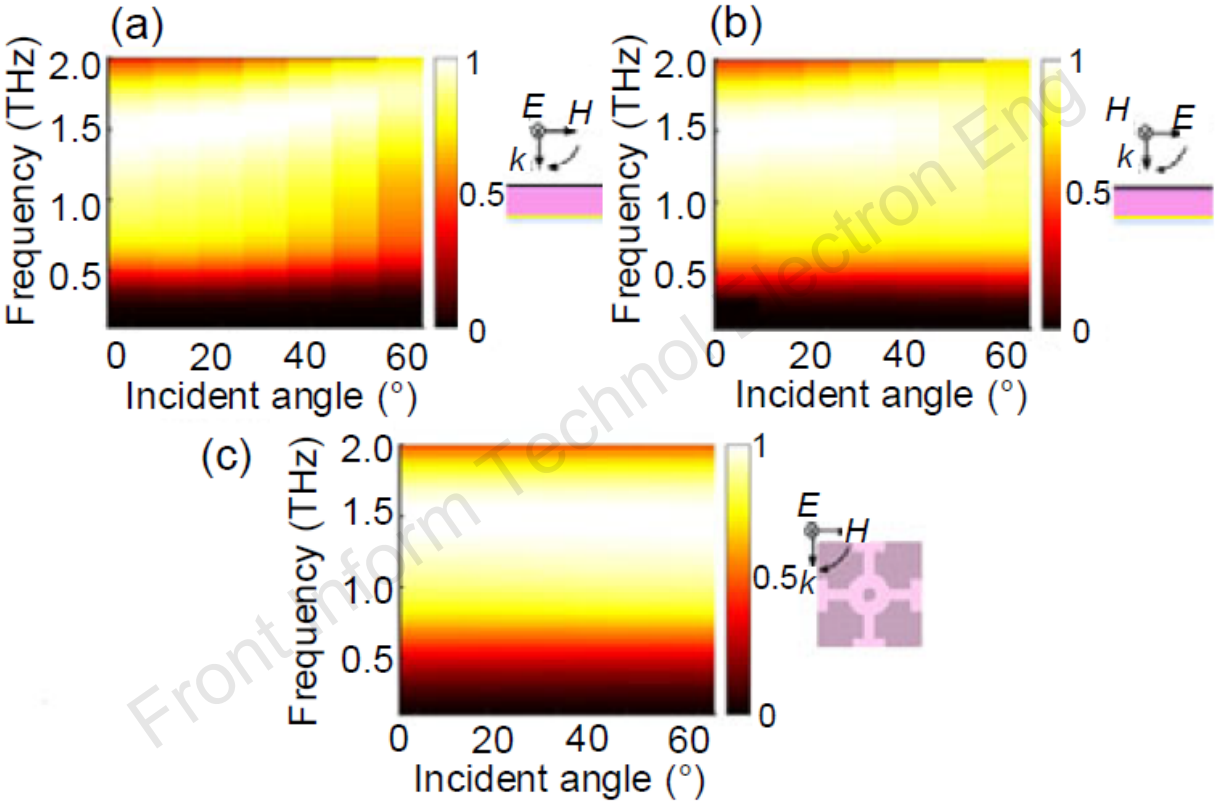


Fig. 6 Absorption spectra with various incident angles for TE-polarized wave (a), TM-polarized wave (b), and the relationship between different azimuths and absorption spectra (c)

Conclusions

1. When the graphene chemical potential is 0.5 eV, the proposed absorber has perfect absorption (above 99.5%) in the 1.36–1.54 THz frequency range.

2. The absorption is above 90% in the 1.05–1.69 THz frequency range.

3. The proposed terahertz wave absorber achieves high absorption in the incident angle range of 0–60°.

Ri-hui XIONG was born in 1978. He received the MS degree in electronic science and engineering from South China University of Technology in 2004. He is currently a lecturer with the Center for THz Research, China Jiliang University. His research interests include terahertz wave and metamaterials.

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